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RECENT STUDIES IN

NAUPATHIA, OR SEASICKNESS

*SYMPTOMATOLOGY, DIAGNOSIS, PATHOGENESIS,
AND TREATMENT BY A NEW AND EFFICACIOUS METHOD*

BY

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RECENT STUDIES IN NAUPATHIA, OR SEASICKNESS.

SEASICKNESS is an affection about which there are many theories and for which a legion of different remedies have been vaunted. This is because it has not been thoroughly studied, and consequently no logical method of treatment has been settled upon that will oppose promptly, constantly, and efficaciously the numerous symptoms of this affection.

The object of this review of seasickness is to give the most complete description of the subject extant and to offer to the medical profession a means of combating the affection that can be relied upon.

There is hardly a morbid state to which man is subject that has resisted the prescriptions directed against it as much as this; there is hardly one which has caused the physician so many deceptions and the patient so much discouragement as this. Therefore the physician has in fact almost wholly renounced treating seasickness in the hope of positively curing it, and the patient rarely calls upon the ship's doctor to treat it. It is truly a strange spectacle of our times to see on board of a great transatlantic liner, for instance, hundreds of passengers violently seasick, keeping their berths, vomiting each instant, moaning, and really suffering atrociously, while the ship's physician, although possessing the medical knowledge and the therapeutic means of our day, is powerless to relieve them.

But this state of impotence in face of such an evil ought not to last indefinitely. Recent investigations made by the writer indicate that there is an efficacious treatment for naupathia, and that the physician will no longer be without arms against this affection. These arms, however, are chosen from among substances at once the oldest and the most active in pharmacology.

It is not lightly and without reflection that the account of our investigations has been prepared for publication. We come with facts and figures and know whereof we speak. We lay them bare for the examination of all, that all may judge of the value of the method of treatment herein explained. Seven years have already passed since the first successful trials of this method of curing seasickness were made. During this time the substances recommended for administration have been thoroughly tried. Laboratory experiments* upon the lower animals were made by us in Paris with Professor Hayem's apparatus with the view of determining the effect of these substances upon the blood pressure. Above all, they have been tried upon the human subject a great number of times. The author has made a special study of seasickness, and his voyages as ship's surgeon amount to nearly sixty thousand miles, while more than twenty-five hundred passengers have been directly under his care. Written clinical reports, eighty seven in number, of typical cases of naupathia form the basis of this article, and the number of times the remedies have been exhibited rises to over three hundred. He may therefore justly claim experience in the matter in hand. This experience was gained in voyages on French steamers plying between France and South America, between Belgium and the United States, between France and the United States, and between Portugal and the United States.

It was during a voyage from Havre to Buenos Ayres and return, on board the steamship Dom Pedro, that this method was employed for the first time. The long voyage lasted two months and a half and furnished ample opportunity to observe seasickness, and indeed not only among

* W. Skinner, *Bulletin général de thérapeutique*, Paris, July 15, 1886, p. 29.

passengers but also among seamen. Details of many cases will be given in another part of this article.

I. SYMPTOMATOLOGY.—In order to accurately understand the pathogenesis of naupathia, which will be elucidated later on, it is necessary to have in mind the *principal symptoms* of this affection, which are much more numerous than former writers have supposed. It will subsequently be seen how these many and diverse symptoms are all united by a common underlying tie which, once perceived, not only explains and harmonizes these various phenomena, but also furnishes an explicit guide to their correction and the cure of seasickness.

1. The most important of these symptoms, which are also the most distressing to the patient, arise from the *central nervous system*, and especially from the brain (cerebrum) and the medulla oblongata. To this category belong the extreme prostration of the patient; the asthenia and feeling of great weakness, which render the seasick incapable of making the least exertion and which oblige them to keep abed days and even weeks; the vertigo, the terrible feeling of instability, as if all were about to disappear in an immense abyss; the cephalalgia, mostly frontal, often temporal, sometimes general; the sensation of heaviness in the head, of constriction of the temples; the feeling of malaise, of indefinable torture; and, lastly the insomnia, which may and often does deprive the patient of all repose during several consecutive days.

The various reflexes (corneal, pupillary, pharyngeal, abdominal, tendinous, and plantar) have often been tested and found normal.

There is still an important symptom which had considerable influence in determining the treatment of seasickness by the new method; this symptom is *myosis*, which is often present in this affection. It is undoubtedly dependent upon the state of the nervous system, and indeed of that of the great sympathetic division of the nervous system. The interpretation of this phenomenon will be found in the third part of this article.

The pupils retain their reflex activity both by the action of light and by the effort of accommodation.

2. The digestive apparatus also presents a great con-

tingent of symptoms, and these are the most striking to non-medical observers.* Mentioned in the order of the anatomical regions in which they occur, there is, first, coldness and pallor of the lips, ptalism, and the foul taste sometimes perceived in the mouth. The tongue, in uncomplicated seasickness, is always uncoated, rosy or pale, humid, and generally in a normal state.

Anorexia is one of the earliest symptoms that announce the approach of seasickness. Nausea follows closely; then appears the vomiting, which at first sight seems to be the principal and the most characteristic symptom of this affection. This last may be absent in light cases, but it is very rarely lacking in cases of average or of great intensity. At first alimentary, the vomiting next becomes mucous, then bilious. Hæmatemesis is not present in simple cases.

The act of vomiting is not without utility. It is not, however, in purging the body of certain matter supposedly noxious that its usefulness lies, but, in fact, by the *effort* which precedes and accompanies it, and which has for one of its effects the forcing of a certain quantity of blood to the brain and to the medulla, which stand in such need of it. In other terms, this effort momentarily activates the encephalic circulation, and the period of calm and of relative euphoria which follows may be due solely to this reflex act. Emesis may thus be regarded as an attempt on the part of Nature to re-establish the normal state of the organism.

From another point of view emesis is a cause of exhaustion of the patient's strength, not only by the violent muscular contractions, often repeated, which are necessary for its accomplishment, but also by the loss, often considerable, of nutritive albuminoid or mineral substances which are rejected by the mouth.

There is sometimes pain in the epigastric region produced by the numerous efforts at vomiting, and in some cases the patients exhibit a veritable gastralgia due largely

* Many of these symptoms might with reason be referred to the nervous system, but they will be named here as if they depended principally upon the organs with which they seem to be the more closely connected.

to abstinence from alimentation, but otherwise this phenomenon does not enter into the symptomatology of seasickness.

What is more important than the preceding, and more constant, is constipation, which, it is believed, never is lacking in uncomplicated cases. This may be more or less pronounced, but it constantly exists in simple cases. Its cause resides certainly in a paresis of the muscular tunic of the intestine. This point will be treated of again when the rôle of the ganglionic nervous system in the production of naupathia is dwelt upon in another part of this treatise.

The liver and the spleen present nothing abnormal; in any case, the latter does not acquire a volume sufficient to render it perceptible by palpation. The abdomen remains normal in its form, its consistence, and its sonority.

3. The physician obtains from the *circulatory apparatus* quite a series of signs and important symptoms, which furnish valuable indications for therapeutic measures. They indicate, in general, a *slowing of the circulation and a lowering of the arterial blood pressure*. The cardiac pulsations are weaker than the normal. As to their number, it follows from my observations that in men there is almost always diminution or bradycardia—several times the number was 57, 51, 48, and even 45 per minute (Case VIII); that in women the number is increased (tachycardia) as often as diminished, and not infrequently the number remains normal (maximum observed, 114 per minute, *without fever*; minimum, 51); and that in children it is almost always, if not always, increased (maximum 120, without fever).

The pulse constantly presents a *diminished resistance*, a greater depressibility than the normal. This is manifest in each patient in comparing his pulse during the attack of seasickness with that which he has when he is cured. The pulse is small, feeble, easily compressed, often perceptible with difficulty. It is regular and equal, without change of rhythm.

The capillary circulation appears retarded. The extremities of the patient, also the ears, the nose, the lips, are cold and clammy. The cutaneous circulation is so diminished that the skin presents several phenomena useful in

establishing the diagnosis, and which will be examined in a moment.

In regard to the constitution of the blood in seasickness, there has been no opportunity to examine it.

4. The striated muscles subject to volition offer nothing in particular; the heart has already been mentioned.

The *unstriated muscles*, on the contrary, are evidently paretic, as was said in speaking of constipation. To such a state of paresis may be attributed the inertia of the intestine, that of the radiating fibers of the iris in myosis, and there may also exist a paresis of the muscular tunic of the blood-vessels, which would explain, in a certain measure, the lowering of the blood pressure.

5. The *skin* is extremely pale, cold, and often moist. Immediately before emesis occurs, synchronous with the nausea which precedes it, the skin receives a renewed wave of perspiration, which renders it still cooler and moister. The natural color of the skin may disappear to such an extent that the patient has almost the aspect of a cadaver—an aspect sometimes increased by a slight greenish-yellow tint in very severe cases. This peculiar condition of the skin, the incessant vomiting, and the great prostration manifested by the patient would easily make a person unaccustomed to the sight believe that the sufferer before him was in danger of dying, so violent and so threatening are the divers symptoms. This state of the skin (pallor, abnormal tint, coldness, moisture) depends on the defective circulation in this organ, causing cutaneous anæmia.

6. The *urine* is remarkably diminished in quantity (oliguria). Hardly does the patient feel the need of evacuating his bladder once during the twenty-four hours, and even when he does so, it is only a hundred, two hundred, or possibly three hundred cubic centimetres that he passes, instead of the normal fifteen hundred. The quantity is so small that it is with difficulty that the physician can procure enough for analysis. Nevertheless, we have been able to get enough from several patients to make analyses thereof. In their cases the urine was clear, acid, amber-colored, devoid of sediment, free from albuminoids (albumin, peptone, or others) and from glucose. More research in this direction, however, is greatly to be desired.

7. Naupathia is an apyretic affection. The central temperature of the patient in simple cases does not rise above the normal, and it varies only within narrow limits. The maximum I have observed was 37.7° C.; rectal temperature (the minimum), 37.3° .

The general aspect of a person suffering from seasickness rather severely is well fitted to inspire pity in one observing him. The extreme decoloration of the countenance; the indifference of the patient to all that transpires about him, which is sometimes so great, it is said, that women lose the feeling of shame and modesty, and parents the parental love for their children; the sufferer's apathy; the distress depicted in his face and his attitudes; the moaning that escapes him; the lack of sleep and of all restorative repose; the constant nausea and emesis—all these phenomena witness to the existence of a really insupportable state of body and mind, which claims with a loud voice the relief obtainable from men of our profession.

II. DIAGNOSIS.—The diagnosis of this affection is so easy, in general, that any one, no matter who, is able to make it. There is no difficulty, except in certain cases which will be indicated below, or in those in which naupathia is complicated by the synchronous presence of another disease.* In certain affections of the digestive tract, for instance, vomiting occurs as a symptom, and it is not always easy to determine whether it is due to the local disease (gastritis, indigestion, helminthiasis, etc.), or to a general affection (seasickness). But if, with symptoms of a disease of the digestive tract, there is abnormal salivation, notable diminution of the frequency and abundance of urination, unusual paleness, coolness, and moistness of the skin, atresia of the pupils with conservation of their reflexes from the action of light and of accommodation, absence of fever and presence of vertigo and of peculiar distress and prostration, then it is certain that the case is one of seasickness.

Shall we go farther and make a differential diagnosis between naupathia and another disease more frequent in children and in adolescents—quite rare among passengers

* It is understood, of course, that the patient whose case is to be diagnosed is in a situation favorable to the development of naupathia—i. e., upon a boat, in a railway train, a carriage, or the like.

on the sea, it is true, but which might, nevertheless, be observed there? This disease, extremely grave, presents several symptoms in common with naupathia. It is a disease characterized by an onset often rapid, especially in warm climates, by intense cephalalgia, by extreme prostration, by repeated emesis, and which is none other than cerebral meningitis. These symptoms, with pallor of the skin, which is sometimes observable in meningitis, are present in both affections, and when the latter is caused by insolation (which happens in the tropics), occurring during the first hours of a voyage, for instance, it is extremely important to be able to make the diagnosis with promptness and precision.

The signs which help to distinguish meningitis from seasickness of extreme or even medium intensity are relative to the cephalalgia, to the pupils, to the salivary secretion, to the vomiting, to the vertigo, to the peculiar distress and torture of the seasick, and to the temperature.

The cephalalgia of generalized cerebral meningitis is diffuse, and felt in all the regions of the encephalon at the same time, while in naupathia it is oftener limited to one of the anterior regions of the head (frontal, supra-orbital, or temporal regions). It is severer in meningitis, and the complaint it provokes from the patient is very different from that arising from the headache of the seasick.

The pupils are often in mydriasis in meningitis; they present a diminution or an abolition of their reflex contractility, and they are often unequally dilated. In seasickness, however, they are predominantly atresic and their reflexes are intact. Moreover, there is no photophobia in the latter.

The salivary secretion is little influenced in the former case; on the contrary, it is habitually increased in naupathia.

Emesis is less frequent, less noisy, less violent, and less frequently preceded by nausea in meningitis than in the other affection.

The temperature of the body is abnormally elevated in the first; it remains normal or else falls a few tenths of a degree in the second.

Finally, one might add that the pallor of the face in

meningitis often yields place suddenly to flushing, and that without appreciable cause, while in naupathia scarcely does the paleness, even after vomiting, merge into a trace of color for a few moments.

Upon seas bordering on unhealthful countries where certain diseases reign endemically or epidemically, it is possible that cholera might be mistaken at first for seasickness. The pallor and moisture of the skin, the vomiting, the prostration, the anxiety of the patient, and the suddenness of the onset certainly render the two affections comparable to a certain extent in regard to their symptomatology. But in naupathia the diarrhœa, so frequent if not constant in cholera, is absent, as well as the thirst, the injection of the conjunctiva, the cadaveric aspect of the face, or else its typhoid appearance, and the notable hypothermia, also the hyperthermia, both of which may occur in cholera and are easily determined. It is unnecessary to longer insist on the elements of diagnosis of these two affections.

Certain *poisons* produce a symptom-complexus that can be confounded with seasickness. It is those forms of poisoning which include among their symptoms vomiting, prostration, pallor of the face, and distressing pain or anxiety that resemble the latter affection. But in cases of poisoning producing vomiting there is habitually diarrhœa also, which latter is foreign to naupathia. Again, the study of the temperature, of the seat and character of the pain, of the ejecta, and of the concomitant circumstances, will furnish a sufficient number of elements for the diagnosis of these two classes of affections.

Finally, in all *fevers* with sudden onset and having emesis among their prominent symptoms, the simple use of the thermometer will afford all necessary information for differential diagnosis.

III. THE PROGNOSIS of naupathia uncomplicated by other morbid states ought, in our opinion, to be always favorable as to the life of the patient. Some authors have maintained the contrary, but we have not found in the literature of the subject the relation of a single simple case having terminated in death. It is true that a person may have seasickness so severely and so long that his nutrition may

suffer to a very great extent, as indeed one of my cases (XIII) shows. De Rochas* relates that a nun who sailed for Australia did not arrive there till the end of six months, and she was seasick during the whole time. She could retain nothing upon her stomach, and her emaciation was so great that on the day of debarkation she was reduced almost to a skeleton.

Similar cases have been observed when voyages were made exclusively by means of sailing vessels and which have consequently lasted a long time. But the sea has not been (to our knowledge at least) the cause of grave or fatal accidents in persons otherwise healthy. Such accidents as the production of a hernia, a cerebral hæmorrhage, or the rupture of an aneurysm, which might be occasioned by the effort of vomiting, should be laid to the account of an anterior abnormal or pathological state. As to miscarriage or premature parturition, we know of no authentic case in which it was caused by seasickness. Even in pregnant women almost at term, delivery seems not to occur before the end of the normal duration of gestation.

IV. *ÆTIOLOGY AND PATHOGENESIS.*—A. *Part based upon Observation and Experience.*—Let us briefly examine the few remote predisposing causes of naupathia. In the first place, it is not at all necessary to travel upon water to be seasick, or at least to exhibit the symptom group called seasickness when encountered on water. There are persons in whom merely the sight of a boat tossed by the waves suffices to render them seasick even while they themselves are standing on dry land. Others are sick on the railway train, in a carriage, even on horseback. The common swing and the merry-go-round possess the well-known property of producing nausea and vomiting in many persons who try these forms of amusement. A ride on a camel or a dromedary also provokes the appearance of this affection in predisposed persons. The nausea, weakness, and lypothymia felt by certain individuals on looking down from the height of a precipice, or of a column, or when they mount near the summit of a high mountain, are indicative of pathological states analogous to seasickness. We see, therefore, that the expression *naupathia*, or seasickness

* *Dict. encycl. des sciences méd.*, art. Mal de mer.

is too restricted to designate an affection which manifests itself in conditions so varied, and it is desirable that a term more scientific and more general be chosen in medical nomenclature to designate the morbid state in question.

Naupathia can not be considered a microbic disease, as one writer would have it,* who imagined a "marine miasm" to be the cause of the sufferings of travelers on the sea. His hypothesis, however, is not supported by any kind of proof. One can not admit, therefore, that this affection is infectious or contagious, which excludes the possibility of epidemics, properly speaking, of naupathia.

Meteorological conditions have no determined influence in the production of this affection. No age is exempt from it unless it be that of early infancy. At two years of age children may be seasick. The influence of sex is quite evident. It is especially women that are seasick. Below the age of puberty, however, this condition loses its influence. Young girls are not oftener sick than young boys. The explanation of this peculiarity is found in another part of this treatise.

The temperament of the passenger, his force of will, have really but a slight effect in warding off an attack. A much greater safeguard is the great interest in the voyage itself as felt by a person taking an ocean trip for the first time. The keen enjoyment of the novelty of the unusual surroundings has often kept a person from seasickness who on later voyages was numbered among its victims.

Other conditions favor the development of this trouble. Thus, the smallness of the ship or boat, the situation near either of its extremities where the motion of elevation and descent (pitching) is greatest, disagreeable odors, the sight of dirty kitchen utensils or of unappetizing dishes, and the possession of what is called "a delicate stomach" (although this organ is for nothing in the causation of most cases of seasickness)—all these things, we affirm, have a real ætiological influence.

Likewise the coexistence of certain other morbid states favors the development of naupathia. Thus persons having a catarrhal affection of the digestive tract, and especially those presenting a disease of the circulatory apparatus, are

* Sémanas, 1850.

particularly exposed to an attack of seasickness. As an example of the first-named cause we recall the case of a sailor of the Dom Pedro who, in the middle of a voyage of twenty-four days, was ill of a catarrhal gastritis, and after a day or two later presented the characteristic symptoms of naupathia.

Cases of the second group are frequent, and insistence should be made in regard to the active rôle which cardiac affections here play. Valvular and orificial lesions of the heart; dilatation, steatosis, and fatty coating (*surchargé graisseuse*) of this organ, and its hyposthenia from whatever cause, are powerful predisposing causes in the production of this affection. We have seen a very obese lady whose heart beats were rather feeble, without other signs of hyposthenia or of other disease of that organ, and whose pulse tension was below the normal, in whose case one might properly suspect the existence of fatty heart, which lady has never taken a sea voyage without being seasick during the whole passage. Another woman having a pronounced mitral insufficiency suffered excessively from seasickness without getting any relief whatever from treatment that is usually efficacious. These examples could be multiplied, but they are sufficient to show the relation that exists between naupathia and any disease of the circulatory apparatus that destroys the physiological equilibrium of the circulation.

It is by no means necessary, however, that a *lesion* be present in some part of the circulatory apparatus in order that the affection which is under consideration be produced. A *functional perturbation* of the circulation is also adequate to produce it. It thus happens that such a large number of children and young persons of both sexes (who certainly have not all a cardiac or other disease) become sick during the first hours of a voyage, or of a spell of rougher weather than usual. It should be remarked that among the organs of circulation there should be included the sources of *innervation* of the heart and vessels—that is to say, the crura cerebri (Meynert), the pons, the medulla oblongata, the spinal cord, and the ganglionic system of the great sympathetic, all of which are centers of cardiac or of vaso-motor nerves. Therein lies a point of major im-

portance in the therapeusis of naupathia, as will be shown a little further on.

There are, of course, many other states and conditions that predispose to naupathia. They may be summed up in the statement that in general (but not always) the states or the affections that enfeeble the forces of the organism render it apter to be seasick.

It has come to the writer's knowledge that certain individuals who were habitually sick at sea during voyages taken in youth and middle age gradually lost this tendency to seasickness during their advanced years. To what may this immunity be due? From our investigations in seasickness, we are convinced that the true explanation of this immunity is found in the growing inelasticity of the arteries as age advances and in the increasing insensibility of the various organs and tissues to the different excitations which figure as the causes of naupathia.

B. *Theoretical Part.*—The enumeration of the above facts is quite insufficient to satisfy the legitimate desire to know what is, after all, the real and ultimate cause of seasickness. The different causes just mentioned do not explain to us the nature of this trouble, do not give us a glimpse of the bottom of the case. Thus many an attempt has been made to reason out the matter and to discover if possible the pathological process itself and to understand how it is that the voyager, perfectly well one moment, is transformed into a sick person in the short space of a few minutes or a few hours.

There have been many other observers who, even centuries ago, have sought to explain this action of the sea. Hippocrates had his opinion of this also, but the theories of our times are more ingenious, if they are not more satisfactory, than that of this author. Thus Darwin affirms that "seasickness is due to vertigo," which, however, is no explanation at all, for the vertigo is part of the affection, being one of its chief symptoms.

Wollaston, with his "barometric theory" of seasickness, divined something of the truth perhaps; but he does not quite satisfy us.

Pellarin * goes further and says: "Seasickness is essen-

* *Comptes rendus de l'Acad. des sciences*, 1847, t. xxiv.

tially determined by the influence exerted upon the circulation of the blood by the movements which the body undergoes and which have for principal effect the lessening of the ascending force of the blood in the aorta and in the arteries springing from the aorta, whence results a hyposthenic state of the brain from anæmia. The insufficient excitation of the cerebral organ immediately determines, by sympathetic channels, contractions of the diaphragm which provoke vomiting, of which the salutary effect is to cause a reflux to the brain of the blood which was lacking." This, we think, is true as far as it goes, but is incomplete and insufficient as an explanation. It confirms, however, our own ideas about the temporary utility of frequent emesis.

Autric * believed he could incriminate the cephalo-spinal liquid. According to him, this liquid would produce a shaking of the brain by the violent flux and reflux which it would make at each movement of the ship—a very ingenious theory, but too fantastical and improbable. It is rather surprising, though, to notice how almost every well-informed writer on naupathia mentions it, some to uphold and defend, some to hold in doubt, but most to repudiate. In verity, how should this beneficent liquid, placed by kindly Nature as a cushion around the central nervous system, become in turn a veritable battering ram to cause such misery on the sea? How could this scanty fluid pass through its narrow channels of communication with volume and force sufficient to produce the shocks or disturbance attributed to it? Compare the quantity of this liquid with the quantity of blood in the brain and spinal cord and observe how little it is; compare the lumina of the connecting passages for the liquid with the open calibers of the turgid blood-vessels, and decide through which class of channels the "flux and reflux" could occur most easily. We do not lose sight of the dynamic difference in the two fluids while making the above statement. One is in active movement while the other is not; both, however, are under a certain degree of pressure. It is more rational, if one wishes to make seasickness due to some lack of equilibrium in the

* *Montpellier thesis*, 1868.

fluids of the encephalon, to attribute it to the blood rather than the cerebro-spinal liquid.

Gillchrist (1774) (?), Sper, and Larrey have supposed that seasickness was due to cerebral commotion produced by the oscillations of the ship.

According to Kérodrén, "the movements of the ship cause disturbance in the play of the diaphragm and of the abdominal organs which are subject to collisions quite suitable to produce the spasmodic state and the convulsions of the stomach. The irritation of the phrenic nerves causes the diaphragm to contract. The ramifications of the pneumogastric and of the trisplanchnic nerves of the semilunar ganglia, likewise subject to these oscillations, react upon the stomach, the intestines, and the whole organism." These notions are not entirely conformable to the teachings of physiology, for the stomach does not play the principal rôle in the act of vomiting, as Magendie has so well demonstrated. Moreover, they do not explain very clearly the pathogenesis of the trouble.

Chapman * has published an opinion contrary to that of Pellarin, cited above. He believes rather in an abnormal afflux of blood to the posterior part of the nervous centers, and especially to those segments of the spinal cord that have relations with the stomach and with the muscles that have to do with vomiting. Still the same idea! They wish to make the stomach guilty of causing seasickness. It may have accomplices, so to speak, but still it is the most to blame. The stomach, nevertheless, has little to do with the production of naupathia.

One author will have it that irregular and insufficient respiration is the cause of seasickness. Therefore he would have his patients practice deep and regular breathing. Another believes the cause to lie in a disturbance of the muscular sense. The most far-fetched and pedantically expressed theory of the ultimate cause is that of Rosenbach,† who says: "For the origin of the symptom-complex of seasickness molecular disturbances are to be made responsible." These molecular disturbances (purely hypo-

* *Functional Diseases of the Stomach*, Part I, London, 1864.

† Zur Lehre von der Seekrankheit. *Berl. klin. Woch.*, 1891, xxviii, 260, etc.

thetical, for that matter—W. W. S.) are caused “through intense intramolecular vibration” or shaking due to the motion of the ship. Unfortunately for this theory, the author is not able to derive from it the slightest aid in treating the affection, and the physician and patient are left as helpless as before.

Many American writers, such as the late Dr. Fordyce Barker, the late Dr. George M. Beard, Dr. J. Leonard Corning, and others, have devoted interesting articles to the subject of seasickness.

Having thus outlined the principal theories that other authors have advanced as to the remote cause and intimate nature of naupathia, let us describe still another one which, though new and entirely original with the author, has already been productive of rich therapeutical results. In other words, we will here expose our conception of the pathogenesis of seasickness that, followed to its logical conclusion, has indicated a mode of treatment unusually successful.

At the time this theory was accepted, after a thorough and independent study of seasickness, we were wholly unaware of those of other observers, for our researches into the literature of the subject were not made till long after our theory had been put into practice.

It is to be stated as an initial proposition that *the principal symptoms (q. v.) of seasickness, if not all, depend* (1) *upon an abnormal state of the circulation of the blood*; (2) *upon an abnormal state of the nervous system.*

Certain of these symptoms (vomiting, acceleration or slowing of the cardiac pulsations) are attributable to *anæmia of the medulla oblongata*; others (prostration, vertigo, and feeling of great distress) to *anæmia of the brain*; still others to *anæmia of the skin*; the oliguria, to a diminution of blood pressure in the kidney. On the other hand, the constipation, the feeble resistance of the pulse, and probably also the variation in the number and in the force of the heart beats, indicate the *diminution or the absence of action of the sympathetic nervous system* upon the unstriated fibers of the intestine and of the arteries, and also upon the intracardiac nerve ganglia.

This question of the *anæmia of the nervous centers* is

interesting, but is one which at first sight is not easily explainable. Does there exist in naupathia a general anæmia of the whole organism? We think not. How can it be admitted in effect that a person who only a few hours before becoming seasick was enjoying perfect health, who might even have been plethoric, could suffer in so short a time a change in the quantity or quality of his blood, so that one is forced to believe in the existence of a veritable anæmia of the whole organism in the ordinary sense of the word? It is a supposition evidently inadmissible. It can not be admitted that there is notably less blood in the body of a seasick person than there was in his body a few moments or a few hours before, when he was not yet sick. Therefore the quantity of hæmoglobin and the number of globules remain the same. How explain, then, the symptoms commonly attributed to anæmia of different organs? Without wishing to deny in any way the existence of this kind of *local anæmia* of the nervous centers, we feel able, on the contrary, to affirm and to explain its presence by attributing it (as we have already hinted) to general disturbances of the circulation of which they constitute but a feeble part. These disturbances we are about to study.

1. *The cause of naupathia is a general lowering of the arterial blood pressure.*

This conception of such a great disturbance of the circulation very naturally explains the oft-mentioned bulbar anæmia—*i. e.*, anæmia of the medulla oblongata. If the medulla is anæmic, it is because the arterial pressure is not strong enough to fill and distend its arteries and arterioles. But all the other parts of the nervous system are also in the same condition. We have here a sufficient cause of the feebleness and inactivity of the centers of innervation of the heart and the blood-vessels. These centers are poorly nourished; they can not, therefore, perform their functions well.

We base this opinion (lowering of the blood pressure) upon the abnormal depressibility of the pulse, the coldness of the extremities, the oliguria, the paleness of the skin, also upon the extreme prostration and the feeling of “goneness” to which the seasick are subject, and upon the

vertigo and cephalalgia that are among the symptoms of cerebral anæmia.

2. *The cause of the lowering of the arterial blood pressure is the feebleness of the heart's action, and probably also the slight dilatation of the sanguineous vessels, especially the arteries.*

When there is lowering of intravascular pressure in a vascular system, elastic and closed at all points, as is the circulatory apparatus in man, this lowering can only be due to two conditions: (1) Diminution of the contents of that vascular system, and (2) enlargement of the container, in this case of the vessels. The diminution of the contents of the arteries may result from (*a*) an arterial hæmorrhage; (*b*) the passage of the blood into the veins; (*c*) a lessening influx of blood sent from the left ventricle—that is to say, hyposthenia of the heart or cardiac insufficiency. In seasickness the first of these possibilities (*a*) should, of course, be excluded, but the third (*c*) ought to be considered as having a real influence. The enlargement of the container may result from (1) the dilatation of blood-vessels—above all, of the arteries; (2) the expansion and congestion of those organs that serve as reservoirs for the blood, and which are, among others, the spleen, the liver, and the intestine (Brücke). We shall see that these two factors may also be encountered in naupathia.

There are thus presented at least three causes for producing the lowering of the blood pressure. The cardiac hyposthenia is revealed by the feebleness of the heart beats and by the abnormal depressibility of the pulse. As for the other two (dilatation of the blood-vessels, afflux of blood into the spleen, liver, and intestines), the direct proof of their existence is not easy to give; but the following considerations show how highly probable it is that they do exist. It will be demonstrated in a moment that the sympathetic nervous system which regulates the tonus of the arterial system (Cl. Bernard, Vulpian, Brücke) is parietic, whence the probable enlargement of the caliber of the arteries. On the other hand, Brücke declares that the vascular territory of the chylopoietic system (intestinal walls) is extensive enough to contain nearly all the blood in the body, whence the possibility of the lowering of the blood

pressure by a kind of stagnation of the blood in the chylopoietic system.

3. *The cause of the enfeeblement of the heart's action and of the probable dilatation of sanguineous vessels is the paresis of the cardio accelerator and vaso constrictor nerve centers.*

It is universally admitted that the pneumogastric nerve possesses an inhibitory action upon the movements of the heart by intermediary of the intracardiac nervous ganglia. This is the *inhibition reflex*, so called by Bidder. It is also well known that the cervical portion of the great sympathetic exerts an accelerating action upon the heart. The excitation or stimulation of the nerves issuing from this portion of the ganglionic nervous system raises the blood pressure and increases the frequency of the pulse (Brücke). *Per contra*, when these nerves are paralyzed (by reflex action, by insufficient nutrition, or by other causes) the contrary phenomena are observed. It merits mention that Ludwig and Cyon have demonstrated that these two conditions (elevation of blood pressure and augmentation of frequency of the pulse) may each be independent of the other.

There are, however, other regions of the nervous system that possess a motor action upon the vessels. The principal center—motor and reflex—for the vascular system as a whole is found in the medulla oblongata (Schiff, Goltz, and others). But this vascular center extends along the whole height of the pons Varolii and even into the cerebral peduncles (Meynert). When this center no longer exerts its normal action upon the vessels, these suffer passive dilatation, whence follows a lowering of the blood pressure.

I have already admitted the existence of anæmia of the medulla and of all the cephalic and cervical nervous centers. Owing to the very fact of this anæmia, the vascular centers in those regions are insufficiently nourished and can not therefore accomplish their normal functions. It is the same thing for the cardiac accelerator center. It is by default of excitation from these centers that the heart does not beat so forcibly or so frequently and that the vessels allow themselves to be passively dilated. In cases of naupathia in which the cardiac pulsations are increased in num-

ber this abnormal frequency should be attributed to a co-existing paresis of the pneumogastric.

I have thus endeavored to establish my point which constitutes the third link in the chain of sequences present in seasickness.

4. *The cause of the paresis of the cardio-accelerator and vaso-constrictor centers is a reflex inhibitory influence exerted upon these centers, and originating either in the sensorium or in organs unequally and alternately pressed and pulled about by the movements of the ship, or finally in the walls of the blood-vessels themselves.*

It was seen in the preceding paragraph that the anæmia of the nervous centers is a cause of their paresis. But this cause acts only when seasickness is actually established. The first and initial cause of this paresis should be sought elsewhere, and we can not consider it other than a reflex act of which the starting point is variable.

This reflex act, it has been said, may originate in the sensorium. It is in this manner that we explain the appearance of nausea, and vomiting even, in idiosyncrasic individuals upon merely seeing a boat tossed about by the waves, or upon perceiving an odor that vividly recalls to their mind the bad smells and other unpleasant circumstances of a former sea voyage when they were sick. There is nothing extraordinary in this, for that matter, for everybody admits that these phenomena (nausea and vomiting) are of a reflex order, and that the starting point is very often the sensorium.

This reflex act may also have its origin in the nerve endings in the abdominal and other organs. Kéraudren had already expressed an opinion somewhat similar. It is very rational to admit, in effect, that the organs situated in the great cavity of the abdomen undergo displacements more or less extensive, or suffer from slight collisions or contusions which result from the violent motions of the ship. The numerous nerves distributed to these organs are thus pulled, stretched, contused, and excited, for the abdominal walls are not rigid and inelastic enough to prevent some displacement of these organs. Hence there can arise here a reflex act having as result the production of seasickness by the process above described.

It is doubtless in these data that is found the true explanation of the greater frequency of naupathy in adult women, in whom the abdomen is relatively more developed than in men, and in whom the abdominal walls have become laxer from one or more pregnancies. It results from this that the abdominal organs are less solidly held in place in their normal situation, whence the greater facility of their displacement with all its consequences.

It is possible that there is still another origin of this reflex act in question. Wollaston with his "barometric theory" of seasickness touched closely to this point, but we conceive it in a somewhat different manner nevertheless. We also believe, it is true, in the reality of the influence of the movements of the boat upon the course of the blood in the vessels—an influence comparable to that exerted upon the mercury in the barometer tube by the same movements, only this influence is much less manifested upon the blood than upon the mercury by reason of the difference in the specific gravity of the two liquids. In fact, the column of blood in an artery, as the column of mercury in the barometer, exerts its strongest pressure on its containing walls (artery or glass tube, as the case may be) at the moment when the part of the ship occupied by the patient or by the observer sinks to its lowest point in the movements of pitching and tossing. In other words, as the ship sinks to its lowest between the waves in a violent movement of descent, then the blood, having acquired a positive momentum downward, exerts more pressure than usual upon the walls of the blood-vessel containing it. This extra pressure tends to dilate the blood-vessel, or else actually does dilate it by force, especially if it is situated in the middle or inferior parts of the body. This condition could also be a starting point of the reflex inhibitory act.

It is easy to understand the action exerted upon the different organs and liquids of the body by the movements of the ship when one observes what occurs in cases like the following: On board of a ship, pitching in a heavy sea, a person is seated in a deep chair having easy spiral springs in the bottom. When the ship moves rapidly in a vertical plane, the person seated in the springy easy chair follows a movement which is not exactly that of the ship. In cer-

tain parts of the trajectory the person rises or falls with greater speed than the ship itself does. For instance, during the rise of the ship, especially during the second half of the rise, the person feels himself lifted or pushed up as though about to be shot out of the chair. He has the feeling of a sudden diminution of weight. The spiral springs lengthen out, and the occupant of the chair is actually elevated to a level higher by several centimetres, compared with surrounding objects—tables, windows, etc.—than that which he had an instant before. His back shoots up a little further above the back of the chair than it did before the ship started upward. At the end of the rising of the ship this independent movement on the part of the person ceases, and the two different rates of speed unite little by little, so that both the ship and the person in question arrive at the same instant at the maximum height of their respective courses. A similar difference in the speed of the two objects takes place during the descent of the ship into the hollow of the waves, only in an inverse direction. Now the person sinks more deeply into the soft bottom of the chair as the ship falls. Toward the end of the descent the person feels himself settling harder into the springy seat, as if his weight had suddenly increased or a heavy hand was pushing him downward. Quite at the end of the descent, as for the rise, the habitual equilibrium is re established and the two movements are blended again. This is repeated at each upward and downward plunge of the ship, and the degree of intensity with which this takes place depends upon the violence of the ship's movements. The phenomena just described are real, as any traveler on a rough sea can testify. A person lying in bed during a storm experiences similar movements. Inanimate objects are seen to do the same thing when on springs. Mercury in a barometric tube acts in the same manner.

In regard to mercury in a barometric tube we have undertaken a few experiments to note the rapidity with which the translation of the quicksilver takes place. Interesting results were obtained. The apparatus consisted simply of an ordinary straight glass tube, thirty-six inches long, hermetically sealed at one end. This tube, which had a caliber of an eighth of an inch, was filled with mercury

and inverted into a bottle containing mercury, no air being allowed to enter the tube. When the tube was put vertically with the sealed end upward, there formed the usual Torricellian vacuum of five or six inches in height. The apparatus thus completed was carried to the extreme stern of the ship, where the rise and fall were the greatest during rough weather. It was found that under these circumstances the mercury was animated by very lively movements. As the ship sank into the hollow between the waves the mercury would also start to sink at the same time. The speed of the latter would increase rapidly as the ship was reaching its lowest point; then both the mercury and the ship would come to rest at the same instant. By this sinking of the mercury the vacuum would be lengthened by two or three inches according to the violence of the ship's descent. When the ship rose, the quicksilver would also rise, increasing in speed as it neared the top of the tube. When the ship was at its highest, so was the mercury, and sometimes its momentum had become so great that the vacuum was wholly obliterated, the mercury striking the top of the tube with a sharp click. It will be noticed that this movement of the mercury corresponds exactly with that of the person in the springy chair just described.

With the experiments of the barometric tube in mind, it is easy to admit that the blood in its vessels, especially in such as run more or less in a parallel manner to the long axis of the body, also is affected by an influence of the same kind, although not to the same extent. It can not be supposed that a vacuum is created in any part of the vascular system, but there is certainly the *tendency* to form one when the ship sinks rapidly, and this tendency must certainly impede the circulation to some extent and tend somewhat to expand the elastic vessels.

These facts in connection with the springy chair or bed and the barometric tube are very easy to observe, but it remains to explain them, to know their effects, and to apply them to the study of the pathogenesis of naupathia.

We explain them by supposing that during the first half of the upward or downward movement of the ship the mobile objects mentioned (person in the chair, mercury in

the tube) have acquired a certain momentum which causes them to be displaced more rapidly during the second half of the oscillation in the same direction. This displacement would fail to take place if the person, for instance, sat upon an unyielding seat or stood upon the floor. But it must not be forgotten that the same forces are still at work, and that they affect whatever there is about the body that is not rigid. It is thus that the abdominal organs, being not absolutely immovable in their respective positions, are subjected to movements and to displacements comparable to those presented by the person in the chair. More than this: In the physiological laboratory of the Sorbonne, in Paris, M. Dastre has shown by actual experiments on the lower animals that movements like those of a ship actually do cause the abdominal organs to be shaken about, displaced, and their means of fixation strained. Here, then, is positive evidence of a source of irritation to the nervous system.

We see, therefore, that the various organs of the body may undergo these contusions and collisions, as Kéraudren affirms; that the blood may be hindered in its course, as Wollaston suggests; and we wish to repeat that these phenomena may be the starting point of a nervous reflex act that, according to the chain of causes and effects above described, results at last in the production of seasickness.

5. *There exists in naupathia, once established, a veritable circulus viciosus, which explains the tenacity of the affection and its resistance to divers methods of treatment.*

This vicious circle is thus constituted: The seasickness being in full development with its habitual retinue of symptoms, there had previously been produced (as was demonstrated) a lowering of the arterial blood pressure, by virtue of which the nervous centers do not receive the full quantity of blood necessary to the perfect functioning. These centers, among which are the cardio-accelerator and the vaso-constrictor centers, being insufficiently nourished, can no longer react against the lowering of the blood pressure, and since this lowering is the immediate cause of the naupathia, the organism is thus unable to bring this state of things to a close, which state, without the efficacious intervention of the physician's art, will last indefinitely. It is

only when the organism becomes gradually habituated to its new surroundings that it returns little by little to its normal state, or else the end of the voyage puts an end to the causes of the affection.

In *résumé*, here are the different steps *de initio ad terminum* of the process, as we understand it, which engenders the complexus of phenomena known as seasickness: Movements of the ship about one, at least, of its axes; movements, slight or considerable, and repeated displacements, collisions, and stretchings of various organs of the body, especially of the abdominal organs, and unequal and alternate increase and lessening of the pressure exerted by the columns of blood upon the walls of the arteries and veins; reflex nervous act starting from the displaced and strained organs and from the walls of the blood-vessels, and acting by inhibition upon the cardio-accelerator and vaso-constrictor centers; paresis or paralysis of these centers; consecutive loss of the tonus of the vessels and relaxation of the walls of vessels of medium caliber, and frequently diminution of the number of cardiac pulsations, whence results a *lowering of the arterial blood pressure*; establishment of a vicious circle, which places the organism in the impossibility of issuing spontaneously and immediately from this morbid state; finally, appearance of the external signs denoting the complete development of nau-pathia.

The great sympathetic nervous system is the most important factor in the production of this affection. Its in-activity paralyzes the muscular tunic of the intestine, whence the constipation; paralyzes the radiating fibers of the iris, whence the myosis; paralyzes the accelerator nerves of the heart (at least in men and in half the women) and probably also the vaso-constrictor nerves of the blood-vessels, whence the lowering of the blood pressure with all the symptoms that depend upon it; it favors by its paresis the production of ptialism, as certain experiments of Czermak, Eckhard, and Grützner demonstrate. One might really affirm that *all the symptoms of seasickness, without exception, are explained by attributing them to a paralysis of the grand sympathetic.*

We have already defined the place that this affection

should occupy in medical nomenclature.* It hardly merits the appellation *disease* any more than syncope does, with which it has several characteristics in common. It is not caused or accompanied by any known anatomical lesion; it is only the expression of certain functional or dynamic troubles. It has therefore no pathological anatomy; its pathological physiology is sufficiently described in the preceding paragraphs. Morbid affections without known lesions are generally classed under the name of neuroses. It seems, therefore, that naupathia ought also to be considered a neurosis, and, according to the eminently preponderant rôle that the sympathetic nervous system plays in this affection, it ought to be regarded as a *neurosis of the great sympathetic*. Thus classed, it would be the most important of all the known neuroses of that part of the nervous system.

V. We come now to the most practical chapter of this work—that which concerns the therapeutics of seasickness.

A. *Prophylaxis*.—In regard to the prophylaxis of naupathia, we know of no precautions or remedies for its prevention that are always efficacious, but there is much that one can do to avoid this affection with more or less success.

In the first place, the mental state of the voyager is of great importance. The firm will, the determination not to be sick, is useful up to a certain point. Again, as has been already remarked, the lively interest in the voyage itself, the keen enjoyment of this mode of travel, have often prevented a person from feeling sick while the novelty of the situation lasted.

Various kinds of apparatus have been tried to annul the movements that the body undergoes when aboard a ship during the rolling and pitching. Thus M. Neveu-Derotrie invented an easy chair, made to hold a person always in an upright position. But it failed to obviate all the trouble. M. A. Déchambre has very justly observed that this chair can not avoid following the rise and fall of the ship, which are the most disagreeable movements of all. We would add that the lateral movements of the ship also can not be avoided by using this apparatus.

* W. W. Skinner. The Place that Naupathia, or Seasickness, should occupy in Nosology. *New York Medical Journal*, 1889, xlix, p. 626

According to a principle similar to the one embodied in the easy chair, suspended saloons have been constructed upon certain ships. Messrs. Bessemer & Reed constructed in this way a boat called the Bessemer. Movements due to rolling may, according to the theory, be thus avoided, but not movements due to pitching (or those taking place in a vertical plane), which are the terrible ones. At all events, the trials of this steamer were not successful. Attempts of this kind have doubtless been abandoned.

Another effort to annul the effect of the waves was made when the steamer Calais-Dover was built. It consisted of two hulls fastened together—a sort of nautical Siamese twins. It was hoped that rolling and pitching would be checked by this combination before they caused much discomfort, but this experiment also proved a failure. The double boat is being used at present as a marine hospital in the Thames, near London.

Large ships are naturally less tossed about than small ones are; therefore it is advisable for one susceptible to seasickness to select a large ship for his voyage. But more important still is the *situation* occupied by the passenger. Thus the middle of the ship is the most favorable for the avoidance or the cure of naupathia, since the motion is here the least. For this reason, as is well known, a berth amidships is the most desirable for a person likely to be sick. A stateroom as near as possible to the ship's center of gravity is the best.

A person standing or sitting is more exposed to seasickness than a person lying down. Hence the recumbent position should be assumed by all who wish to recover from an attack, or, being in danger of it, wish to escape it. This fact is in direct accordance with our theory of the cause of seasickness, and brings a strong confirmation of it.

Many authors (Jobard, Fischer, Kéraudren, Fonssagrives) recommend binding the abdomen by means of a broad bandage. Our own personal experience with it convinces us of its usefulness. It certainly gives great relief, and affords a needed support to the abdomen when exhausted by incessant retching and vomiting. One of our lady patients testified to its utility by saying she could not live without it. The bandage employed may be only a

towel or napkin, carefully pinned or sewed around the body so that it will fit the abdomen. It should be wide enough to compress the abdomen from the xiphoid appendix to the pubis without being so tightly drawn as to notably impede respiration. If the abdomen should become so hollow as to render it impossible to accurately fit a bandage around it, the hollowness may be filled up by a soft blanket folded smoothly and fitted into the depression which is most considerable in the lower portion of the region—*i. e.*, between the ossa iliaca.

So much for the mechanical means of prophylaxis. They obviate to some extent the sufferings of seasickness. Let us turn now to the pharmaceutical means about which the same remark applies.

Alcohol in various forms has often been tried by voyagers on embarking who fear the sea. The effect of this agent is uncertain. Some are doubtless helped by it. The same is true of ethylic ether. Certain aromatics have a short favorable effect on a few individuals. The most used are peppermint and cloves. Smelling-salts sometimes ward off the first feeling of nausea, the forerunner of naupathia.

Other substances have rendered real and undoubted service in prophylaxis. They are chloral hydrate, the bromides, morphine, antipyrine, quinine, and, according to some writers, cerium oxalate. Dr. Pritchard (*Lancet*, 1871) has, for one, tried the first-named agent with great success during the short crossing from Dover to Calais. He took enough, however, to put him to sleep.

The sodium and potassium bromides, taken during the three or four days immediately preceding embarkation, have occasionally proved effectual. A drachm (four grammes) per day should be taken in divided doses. Morphine has been recommended, but we have had no personal experience with it as a prophylactic.

Sulphate of quinine in the dose of one gramme (fifteen grains), taken four hours before embarking, has recently been praised by Dr. Ch. Richet, of Paris.

All of the above substances operate by diminishing the reflex activity of the nervous centers, which we have seen to be one of the chief factors in the causation of seasickness. They also (excepting, perhaps, quinine) produce sleep

if pushed far enough, and thus they suspend all consciousness of suffering. Pushed to that extent, however, they deprive one of the pleasures of the voyage, as well as save one from discomfort.

There is an entire class of substances which, according to theoretical views, ought to produce a favorable prophylactic result, and these are the so-called *neuromuscular* agents or drugs, some of which have actually been proved useful. All of these substances, nevertheless, are not equally effective. The following alkaloids, which until recently have been classed among the moderators of nutrition, possess properties that justify their admission into the neuromuscular group. These are cocaine, caffeine, theine, and perhaps also theobromine, guaranine, and kolaine. Taken in suitable quantities, these substances increase the activity of the nerve cell and of the unstriated muscular fiber, as well as that of the striated. Thereupon result several effects, of which the principal one which interests us is the *elevation of the arterial blood pressure*. A great number of experimenters have verified this fact, and we have also repeated these experiments with a similar result.*

Cocaine has often been efficacious as a preventive of seasickness. It acts by producing sometimes sleep, sometimes mental stimulation, sometimes, it is believed, augmentation of the blood pressure, as experiments have shown many a time. Its action, though, is not uniform, and we have seen this alkaloid produce very alarming accidents in seasick women. Several times after it had been taken the number and violence of the vomitings increased. Once a woman having received a hypodermic injection of 0.05 gramme (five centigrammes) of cocaine chlorhydrate presented dangerous symptoms half an hour afterward. The heart beat 180 times per minute; the eyes were red, injected, and tearful; the pupils were ectasic. She had paroxysms of alternate nervous laughing and crying, and did not seem to understand questions addressed to her. Her replies were vague and incoherent, or else she did not reply at all. This state lasted twenty minutes, after which the pulse fell to 134 and its tension increased, and her re-

* W. Skinner. Les effets pharmacodynamiques de certains alcaloïdes, etc. *Bull. gén. de thérapeutique*, July 15, 1886, p. 29

plies became clear. Since then we have not injected cocaine in naupathia. Administered *per orem*, however, cocaine has a good effect.

Caffeine and coffee are excellent remedies in this affection. More will be said of them and of cocaine under the rubric of curative treatment. We can strongly recommend voyagers subject to seasickness to take a cup of a good infusion of pure coffee, pretty strong, at the moment of feeling the *first indications* of the approach of the trouble—*i. e.*, at the first suspicion of nausea, vertigo, prostration, headache, or even of greater paleness of the face than usual. If one waits too long, the stomach will no longer be in a state to absorb anything, for as the sickness increases the stomach is going to secrete a lot of watery mucus which will be ejected by emesis and the coffee with it.

The coffee beans for this infusion should be quite ripe so that they shall contain the maximum of caffeine, and should be moderately torrefied in hot air to favor the formation of a certain quantity of caffeine. The infusion should be taken hot and but slightly sugared, if at all, but the dose should not be repeated too often, for it has been noted that a secondary lowering of the blood pressure has occurred upon the ingestion of too much caffeine. In any case, after the lapse of one or two hours, if the need of a new dose makes itself felt, one might take a strong infusion of black tea (pekao tea if obtainable) in the proportion of three grammes (forty-five grains) of tea to a hundred grammes of water, for, in spite of the identity of theine and caffeine as to their chemical formula, tea does not produce quite the same effect as coffee.

B. Curative Treatment.—The curative treatment of naupathia has up to the present time been much neglected, and when means have been employed they have been of great diversity, and usually inefficacious. So true is the last statement that nearly all ship physicians wholly renounce all attempts to cure the affection and content themselves by merely offering a few suggestions toward palliation, and the patients themselves are generally resigned to await the spontaneous termination of their woes without disturbing the doctor. We see no reason why this state of helplessness should last any longer, for our endeavors to

find a remedy have resulted in the employment of a therapeutic method quite simple in itself yet followed by almost constantly favorable effects.

Before entering into the details of our new method, a word may be said of the few other methods of treatment which have also been suggested by purely theoretical views of the nature and cause of seasickness. Thus Sémanas prescribed quinine sulphate for his imaginary marine miasm. Chapman advised the application of ice along the vertebral columns by means of his special apparatus or spinal ice bag in order to combat the supposed abnormal afflux of blood in certain parts of the spinal cord. We have never known a case in which it was tried, and its application would seem *a priori* inconvenient and disagreeable. Le Coniat practiced with more or less success the faradization of the epigastrium and the hypochondriac regions, employing conjointly with this the painting of a solution of atropine (0.02 to 0.05 gramme in thirty grammes of water) over the region of the stomach. He claims to have obtained really good results, but he did not begin his treatment during the first day of the sickness. This delay permitted the patient to get well, or nearly well, spontaneously, so that one can not tell how much of the cure was due to treatment. Then again the absorption of a certain quantity of atropine would alone cure a mild case.

Antipyrine as a curative agent has been loudly vaunted by some ever since the communication of Dr. Ossian-Bonnet to the Academy of Medicine of Paris in 1887. This author advises antipyrine to be given in the dose of one gramme (gr. xv), repeated if necessary until the patient is better. He gives it also subcutaneously if vomiting is severe. Our own limited experience with this drug was unsatisfactory.

Cocaine has cured some cases, and a former colleague of the author's, Régnauld, of Paris, has published results of this treatment (*Progrès méd.*, 1887). The doses of this powerful drug that he gives, however, are, in our opinion, eminently dangerous. But we have said in another place that cocaine given in small doses by the mouth is an excellent remedy.

There is an unusually effective and agreeable combina-

tion of medicines put up in liquid form and known as naupathic elixir, which has shown itself to be very useful in preventing and curing seasickness. It is said to contain seven different ingredients, each of which has been found helpful in this affection, and two of these are known to be caffeine and cocaine. It is sold by Hazard, Hazard, & Co., of New York. We have personally tried this elixir on several of our voyages as ship's surgeon, and have found it to be very grateful to our patients.

The treatment upon which we rely with the greatest confidence, however, is that about to be described. We were led to choose the two substances which form the base of the medication in the following manner: After having studied the symptoms of naupathia in their completeness, as if no physician had ever seen or written about them before, we were convinced that they were due, above all, to the lowering of the blood pressure, as has been already said, and that this lowering depended upon a paresis of the centers of innervation of the heart and of the arteries, as was above explained. There only remained, then, to choose from the *materia medica* the suitable substances that would raise that pressure by acting upon the nervous centers and the unstriated muscular fibers and to administer them in the most advantageous manner. We chose to this end atropine and strychnine employed simultaneously. But how should they be given? On account of the frequent vomiting in seasickness, by which any ingested substance would be rejected and lost, on account also of the difficulty of absorption in a seasick stomach, where the chief osmotic current is flowing toward its cavity, and, lastly, on account of the action of the liver by which it arrests and transforms these and other alkaloids entering it from the stomach and bowels (Hegar, Schriff, Lautenbach, Jaques, Roger), it was necessary to choose some way of administration of these alkaloids other than that of the gastro-intestinal tract. The hypodermic method seemed to us the best, and it is in this manner that we always exhibit these substances in seasickness.

The dose of these agents by subcutaneous injection in a well-developed case of naupathia should be for adults from a half to one milligramme of atropine and one milligramme

of strychnine dissolved in mint water. The following is the formula we employ the oftenest :

Atropin. sulphat.....	0·02 gramme ;
Strychnin. sulphat.....	0·04 “
Aquæ menth. pip.....	40·00 grammes.

One gramme, or one cubic centimetre, of this solution contains half a milligramme of atropine and one milligramme of strychnine. In hot climates this solution loses a little of its strength at the end of a month, and it should therefore be frequently renewed when used in the tropics. Although we have employed these active substances hundreds of times, we have not yet seen the least harmful result in adults. In regard to the distilled mint water that figures in the formula, we are unaware if it has an action that should be taken into account. It was selected on account of its more or less merited reputation of usefulness in seasickness. If in the space of two hours after the first injection the patient is not cured, a second injection of one gramme (or one cubic centimetre) of the solution may be injected, and even a third two hours later. But we esteem that it is not prudent to exceed this number of hypodermic injections per day in naupathia.

Children and adolescents are very susceptible to this medication. A child of two years and a half (Case III, see *Clinical Reports* at the end), sick during fourteen hours, was promptly and definitively cured by the injection of *one sixth* of a gramme of the solution—that is to say, by circa 0·00008 of atropine and 0·00016 of strychnine—a truly infinitesimal dose. A boy of six years was cured by the injection of a fourth of a gramme of the solution ; another, eight years old, by half a gramme, which was somewhat too much for a lad of his age. (See Cases VI and VII.)

The effects of this medication are often surprising. In the majority of simple cases of seasickness *the patients cease vomiting at once* after having received a *single injection* of one cubic centimetre of the above solution. Soon afterward they feel no more nausea, cephalalgia, or distress. Only a few minutes are required for this result to be obtained. Occasionally two injections are necessary to produce complete euphoria.

Everybody knows what a pitiful spectacle a really very

seasick person presents. He is painfully seated near the ship's rail or a basin or is lying down, caring not how or where, so long as he can vomit easily; he is pale, apathetic, vomiting, and suffering from headache and vertigo. But the injection of these alkaloids transforms this person in a little while. He ceases to groan, the vomiting stops, color returns to his cheek, and he affirms that he is "much better," or that he does not suffer any more at all. If the injection is given during the daytime he almost always falls asleep for half an hour or longer; if given in the evening, when the patient has retired for the night, the sleep is calm, prolonged, and restoring—so much so that when the physician visits his patients on the following morning he hears them assert with satisfaction that "the night was passed very well." This means a great deal to a person who has been kept awake a night or more by seasickness.

One of the best proofs of the efficacy and innocuousness of this method is found in the fact that patients ask for a repetition of the treatment, and mothers who have been treated have it done to their children.

There is another substance which we have employed in seasickness with good results, and that is caffeine given hypodermically.* It acts somewhat more slowly than the alkaloids just named, and its effect is less constant, but it is often efficacious, as the cases related below will show. In our practice we used the formula of Tanret and Dujardin Beaumetz, which is as follows:

Caffeinæ.....	4 grammes;
Sodii salicylat.....	3 "
Aq. dest.....	q. s. ad 10 c. c.

Dissolve by gentle heat. Each cubic centimetre contains 0.40 gramme (40 centigrammes) of caffeine. A single dose of 0.30 gramme injected subcutaneously cured a patient completely in seven hours who had been sick three days. (See Case XI.) In another case this dose cured in five hours in the same conditions.

A mixture of cocaine, caffeine, and atropine did not produce such good results as the mixture of atropine and strychnine.

* W. W. Skinner. Treatment of Seasickness. *British Medical Journal*, October, 1886.

Possible Objections to this Method.—The administration of such toxic substances as atropine and strychnine requires, of course, great attention and prudence on the part of the physician, and none but a physician should give these agents. He should carefully observe their action, and, above all, before injecting them he should accurately proportion the dose to the age and the constitution of each patient. Atropine ought not to be administered too often; once the proper dose exceeded, there follow depression and enfeeblement of the patient.

It was said above that we have never seen harmful effects due to these substances, given as directed. However, there are sometimes produced certain disagreeable effects, though they can hardly be said to be important. The most frequent of these effects is the dryness of the mouth and air passages due to the atropine. But the patients prefer this to being seasick. Children sometimes present a generalized redness of the skin due to the same drug which may cause parents some anxiety, but it soon disappears. Once we noted irregular pulse in a boy after a single injection (Case VI), but his general condition was so good, he laughed and played so naturally, that all idea of danger was rejected.

Atropine given even in a small dose in seasickness sometimes causes temporary amblyopia (Case V). In such cases the proportion of strychnine should be increased and a somewhat smaller quantity of the solution should be injected.

Not infrequently passengers that have been quite severely sick present a certain degree of prostration and an indisposition to make any muscular effort, even after they have been entirely cured of their naupathia by the injection of strychnine and atropine. They are certainly cured because they feel no more nausea, or vertigo, or distress, and they have no more vomiting, pallor, ptalism, etc. This state of languor, of reluctance to move, may last from six to twelve hours, seldom longer. It may be entirely due to the exhaustion which a severe attack of seasickness leaves after it, but it might possibly also be deepened by the action of the atropine absorbed. At all events, the termination of this state is always favorable.

The seat of the injection is not ordinarily painful. Rarely it leaves a painful spot after it, which is tender for a day or two, and very rarely it produces a redness and swelling quite annoying. But we have never observed an abscess or phlegmon as a result of these injections. The inflammatory phenomena subside spontaneously and all is soon in order again. It should be remarked that these accidents are not disagreeable enough to prevent the patients from seeking the same treatment again as soon as they feel seasickness return.

The *counter-indications* of this method are quite rare. When the diagnosis has been correct we have never observed a case rendered worse in any respect by the exhibition of these substances, even when the patient had another disease coexisting with seasickness.

It happens from time to time that the injection of these two remedies does not cause any amelioration ; the trouble continues in spite of all and lasts long. In these cases it is almost certain that the patient has one of those affections that were named among the predisposing causes of naupathia and which are, above all, affections of the circulatory apparatus, as has already been explained.

What is it that we mean by the cure of seasickness ? Do we mean that as soon as the remedies are given the vomiting patient gets right up out of bed and promenades the deck as gayly as if in a ballroom ? By no means. There is no power in the universe that could produce that result while the sea is still rolling high. But we do mean that the vomiting and even the nausea stop, that the splitting headache stops, that the patient is comfortable, that he or she generally falls asleep a little while, and that soon afterward food is relished and retained. The patient may still remain in bed, but he is not seasick, and it is not necessary to wait for still water before this result can be obtained. Can more than this, or as much as this, be said of any other method of treatment of seasickness ?

Let it suffice to say, in conclusion, that the judicious employment of this method never does any serious harm ; that it may very rarely be inoperative, owing to some cardiac, vascular, or nervous lesion ; but that *in simple naupa-*

this it always produces amelioration and generally a cure of this affection.

CLINICAL REPORTS.

A. Treatment of Seasickness by Atropine and Strychnine.

CASE I.—Madame C., Argentine, aged twenty-nine years. She was the first person upon whom this method was employed. She embarked at Montevideo on April 28, 1886, for Havre.

April 29th.—The patient has been sick abed since the departure of yesterday. She has continual nausea and frequent mucous vomiting. Tongue moist, pale-rose, and free from any coating. Intense frontal cephalalgia; great prostration. Pulse, 80, feeble.

At 7.40 in the morning injection (hypodermic) of one cubic centimetre of the solution of atropine and strychnine. At 7.50, pulse, 75. At 8.10, pulse, 120, still feeble. Vomiting has ceased. At 9.25, pulse, 114. Second injection of one cubic centimetre. At 11.15, pulse 114. Considerable amelioration. There is no more headache or nausea; she is inclined to get up. The patient feels well; she has slept since the first injection.

2 P. M.—She is no longer sick at all and remains on deck.

4 P. M.—She is still doing well, although lying down since a moment ago. She suffers from nothing whatever. Pulse, 78, stronger than this morning.

April 30th.—She passed a good night. A little nausea this morning. At 9.30, pulse, 90, of medium force. Injection of one cubic centimetre of the solution.

May 1st.—She is doing perfectly well. Has not even had nausea or headache since yesterday morning.

CASE II.—Madame G., aged twenty-eight years. Same voyage. A very stout lady.

April 29th.—Has been sick since the beginning of the voyage—*i. e.*, since last evening at 10. Tongue clean, complete anorexia, mucous vomiting, constipation since three days ago, frontal headache, great prostration; is in recumbent position.

At 9 A. M., pulse, 75, feeble. Hypodermic injection of one cubic centimetre of the solution of the sulphates.

11.30.—Pulse, 105, stronger. Has much less cephalalgia. Has slept since the injection. *She wishes her two little girls to have the treatment*, as they have both been sick all night.

10 P. M.—She feels no more nausea, though there is some heaviness of the head.

April 30th.—Passed an excellent night, but on arising this

morning she felt nausea and weakness. At 7.30, pulse, 75, feeble. Injection of one cubic centimetre. At 10.30, feels no more nausea at all; headache better; has slept since the injection. *She has eaten with appetite and has retained the food.* After eating she took her work (embroidering), being no longer sick, though the boat still rolls a great deal.

10.30 P. M.—Had a light dinner at 7. Felt a little sick, but no vomiting. The seat of the injections hurt her a little.

Madame G., who has made several long voyages on the ocean, declares that during none of them has she been so little sick as on this one.

CASE III.—Madame G's. children, little girls, one aged five years, the other two years and a half, have also been sick all night and this morning. They had vomiting, pallor, coldness of the extremities, and prostration.

They were treated, in accordance with the repeated request of their mother, in the same manner that she was. The youngest received by injection only one sixth of a cubic centimetre of the solution—that is, 0.00008 of atropine and 0.00016 of strychnine. The elder received somewhat more. The injections were given at ten o'clock in the morning.

At 11.30 A. M. they had not vomited again and were asleep. Two hours after the injection they presented a generalized redness of the skin very pronounced, also slight mydriasis.

2 P. M.—At this hour the children have been for some time on the deck, playing in a lively manner and perfectly cured of their seasickness.

CASE IV.—Madame V., aged twenty-three years, on the same voyage.

April 29th.—She began to be sick about 1 P. M. At three, pulse, 66, feeble; tongue rosy and moist; continual nausea; constipation; prostration, heaviness of the head, face very pale, extremities cold, pupils atresic. Hypodermic injection of one cubic centimetre of the solution.

6 P. M.—Pulse, 84, of medium tension. She has dined and finds herself *quite cured*. The face is rosy; no sensation of heaviness of the head. Pupils normal.

CASE V.—Mrs. W., aged thirty years, same voyage.

April 29th.—Sick ever since early morning. The tongue is normal. Abundant and frequent mucous vomiting. Constipation, frontal cephalalgia, moderate prostration, recumbent position. Pulse, 65, feeble.

8.35 A. M.—Hypodermic injection of one cubic centimetre of the solution. At nine o'clock she gets up and feels no more nausea; she feels well; the face is no longer pale as before; there is no more headache or prostration.

6 P. M.—The amelioration continues. She has dined well and shows no symptoms of seasickness.

10 P. M.—Some nausea on retiring for the night. Pulse, 72. No other symptoms. Injection of one cubic centimetre.

30th.—She passed a very good night and feels in excellent health on arising this morning.

11.35 A. M.—Vomiting since breakfast at ten. Some frontal headache. Pulse, 72. Injection of three fourths of a cubic centimetre of the solution of the two alkaloids.

1.30 P. M.—Pulse, 100, rather strong. The patient says that since half an hour ago she does not see well; there seems to be a veil before the eyes. No iridescence upon objects seen, no mydriasis, no other inconvenience from the injection (amblyopia).

7 P. M.—She has vomited a little once or twice since dinner at five o'clock. Dryness of the mouth.

The patient, who has made other voyages, affirms that she has never been so well during their first days as she is during this.

May 1st, 7.45 A. M.—Examination shows that the heart is normal. The corneal, patellar, and plantar reflexes are normal. The patient is still lying in bed. Pulse, 81, tension and rhythm normal. Has slight frontal headache. Face slightly congested, pupils normal, extremities warm; constipation since three days. By precaution (because she has no nausea or vomiting for the moment), a pill is given her which contains quinine sulphate, strychnine sulphate, belladonna extract, and alcoholic extract of rhubarb. This pill was administered three quarters of an hour before she arose. She vomited but once, and that was two hours after arising.

11 A. M.—Less headache, no more visual trouble. She reports herself much better. Pulse, 75, of medium strength.

She was not seasick any more during the voyage, which lasted twenty-four days.

CASE VI.—Master W., aged eight years, son.

April 29th.—Began to be sick after breakfast at ten.

3 P. M.—Nausea; tongue slightly coated; abundant and troublesome salivation; no headache; notable prostration; position half reclining and motionless; very marked pallor of face, coldness of extremities, pupillary atresia; pulse, 72, feeble. Injection of half a cubic centimetre of the solution.

7 P. M.—Pulse, 78, stronger, but somewhat irregular. He has not been sick at all since receiving that single small injection. He is gay and smiling on going to bed. The pallor of the face is replaced by a rosy tint. There is no longer any abnormal salivation.

May 6th.—Was not seasick any more during the voyage.

CASE VII.—Master Augustus W., aged six years, son.

April 29th, 5 P. M.—Has vomited several times; is dull and listless; pallor of face, coldness of extremities, pupils normal; pulse, 84. Injection of one fourth of a cubic centimetre.

7 P. M.—Pulse, 108, of medium strength. Remarkable amelioration in general condition. Sleeps quietly without having had any more vomiting. Cheeks rosy, hands warm.

30th.—Is no longer sick at all. Plays gayly, as does also his brother.

May 6th.—Remains thoroughly well.

CASE VIII.—Mr. B., aged thirty-eight years, same voyage.

April 29th.—Has been sick all day and stayed abed. *He has not ceased to vomit almost continuously.*

6 P. M.—The mucous vomiting continues very profusely; complete anorexia; constipation; tongue slightly foul; no frontal headache; very great degree of prostration. Pulse, 57, of medium tension. Injection of one cubic centimetre.

9 P. M.—He feels *no more nausea at all*. He has slept soundly since the injection. The face is no longer pale.

30th.—Passed an excellent night. Slept soundly without any nausea.

6.30 P. M.—He received no injection during the whole day and *was seasick all the time*. This evening he has vomiting, pallor of the face, very decided coldness of the hands, cephalalgia, prostration, and weakness. The patellar and corneal reflexes are normal. Heart healthy. Has had a semisolid stool. Pulse, 45, feeble. Injection of one cubic centimetre.

May 1st, 8 A. M.—The night was passed very comfortably. This morning the extremities are warm, the face rosy, and there is less prostration. Pulse, 48.

CASE IX.—Mlle. S. V., aged nineteen years.

April 29th, 12 M.—Alimentary and mucons vomiting; tongue clean; occupies a sitting position; no headache. Pulse, 100, feeble. Injection of one cubic centimetre.

2 P. M.—Pulse, 114, stronger. No more vomiting, and not even any nausea.

6 P. M.—Pulse, 51, medium tension. Commenced to vomit again after dinner at five.

7 P. M.—Pulse, 57, feeble. Injection of one cubic centimetre.

May 5th.—*The patient has shown no more symptoms of seasickness since the last injection.*

CASE X.—Mlle. Catherine X., aged thirty-six years. (This case is interesting on account of the failure of the treatment owing to a cardiac lesion.)

April 29th.—Patient is sick since early morning. At 9.30 A. M., injection of one cubic centimetre.

12 M.—Has vomited several times since the injection. Pulse, 116, feeble. Second injection of one cubic centimetre.

3.45 P. M.—No improvement; vomiting has continued since second injection; tongue slightly coated; some nausea, dizziness, but no headache; pupils normal; pallor of face and coldness of extremities. Pulse, 72, feeble. Third injection of one cubic centimetre.

6 P. M.—No amelioration.

30th.—Still some nausea. Toward evening she feels better.

May 2d.—Examination of the heart reveals *well-characterized mitral regurgitation*.

B. Treatment of Naupathia by Caffeine.

CASE XI.—Madame L., aged twenty-one years, sailed from Bordeaux for New Orleans on August 14, 1886, on the steamship Marseille.

August 17th.—Patient has been seasick ever since the departure three days ago. She has not left her bed and has eaten nothing.

9.30 A. M.—Very great prostration; severe frontal cephalalgia; gastralgia. Pulse, 114, small, feeble; rectal temperature, 37.6° C. (99.7° F.).

Treatment.—Subcutaneous injection of three quarters of a cubic centimetre of the solution of caffeine described before—*i. e.*, three tenths of a gramme of caffeine and about a fifth of a gramme of sodium salicylate.

10 A. M.—Pulse, 78, fuller, stronger. She feels better.

11.40 A. M.—Pulse, 75, stronger. Feels herself still better. No more headache or gastralgia. She still remains abed, and is not hungry. Rectal temperature, 37.3° .

4.30 P. M.—Pulse, 90, fairly strong. *She feels perfectly comfortable*, though still abed. Later she went to dinner for the first time since embarking.

20th.—She has been well since last note.

CASE XII.—Mlle. M. P., aged eighteen years. Same voyage as last case.

August 17th.—She has also been seasick ever since leaving Bordeaux three days ago. She keeps her bed and has eaten very little. No evacuation of the bowels since embarking.

10.10 A. M.—Pulse, 84, feeble; rectal temperature, 37.6° C. Cephalalgia; gastralgia. Injection of three quarters of a centimetre (three tenths of a gramme) of the solution of caffeine.

12 M.—Pulse, 72, still feeble and intermittent, as it was also

at first visit at 10.10 A.M. Rectal temperature, 37.7°. No improvement.

4.30 P.M.—Pulse, 96, much stronger. *Notable amelioration.* She talks and laughs with the other passengers, and remains sitting up in bed.

20th.—She remains cured.

CASE XIII.—This case shows the remarkable effect of this method of treatment. Paula X., aged eight years, a tawny-colored native of the Cape Verde Islands, was one of our passengers from those islands to Buenos Ayres. She began to be sick in the dory while being rowed to the steamship, and when on board she was violently sick every day, so that she could keep absolutely no aliments on her stomach, neither solids nor fluids. She was compelled to lie down almost the whole time vomiting at frequent intervals. This state of affairs continued during six days in succession without her receiving any treatment, and by that time she had become so feeble and emaciated that the captain, to whom she was given in charge, became alarmed about her and asked us to apply our method of treatment. At ten o'clock on the sixth day we gave her a hypodermic injection of one third of a cubic centimetre of the solution of atropine and strychnine—*i. e.*, about 0.0003 of a gramme (or about one two hundredth of a grain) of each of these alkaloids. *Three quarters of an hour afterward she sat up at a table and ate and drank with great appetite.* She kept everything upon her stomach without nausea, and from that moment she felt no longer seasick, but, on the contrary, she ate well and soon began to play. The state of the sea had no influence in her recovery, for the weather had been uniformly fair all the time. This is one of the most striking examples of cure we have seen.

We could produce many more clinical reports of trials of this method of treatment, but we judge it unnecessary. It is to be remarked that the above reports cite the disagreeable effects and the failures as well as the advantages and successes of the method. Any physician, on employing the same mode of treatment, would, no doubt, have the same degree of success as we have had.

Conclusions.—1. The principal symptoms of naupathia result from the lowering of the patient's arterial blood pressure. This is a condition *sine qua non* of their development.

2. Seasickness in a person otherwise healthy and not too aged is *promptly curable* in the vast majority of cases.

3. Even in aged persons, or in persons having certain affections of the circulatory apparatus, there is often amelioration of the general condition by the employment of the new method of treatment.

4. The treatment consists in the hypodermic injection of from half a milligramme to a milligramme of atropine sulphate, associated with a milligramme of strychnine sulphate (or nitrate), dissolved in a cubic centimetre of distilled mint water.

5. The administration of these eminently toxic substances demands a great degree of attention, prudence, and supervision on the part of the physician, who alone should be the judge of the opportunity of their administration and of their dose in each individual case. Given at proper times and in suitable doses, however, no harm whatever will follow their administration.

6. The sympathetic nervous system plays a preponderating rôle in the causation of naupathia.

7. Naupathia, or seasickness—an affection without known anatomical lesions, and of which the predominant symptoms have their origin in the nervous system, and especially in the sympathetic or ganglionic nervous system—ought to be regarded as a *neurosis of the sympathetic*.

8. This neurosis may recur during the course of a long voyage, but each attack is almost always amenable to the same treatment.

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